

# **Exploration of Synthetic Methodologies for Carbon-Carbon and Carbon-Heteroatom (N, O, S) Bond Formation Reaction Catalysed by Cu & Pd**

A thesis submitted in partial fulfillment of the requirements  
for award of the degree of

**Doctor of Philosophy**

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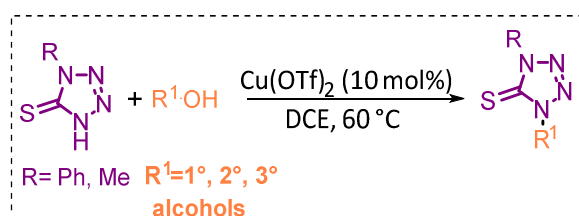
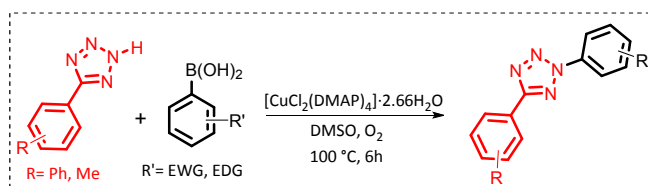
**Assam, India**

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## 6.1 General Conclusion

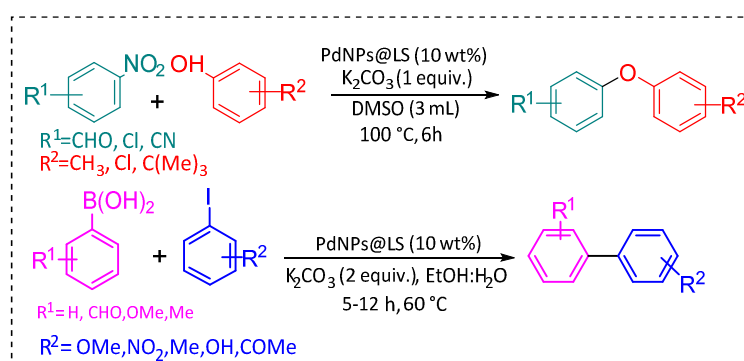
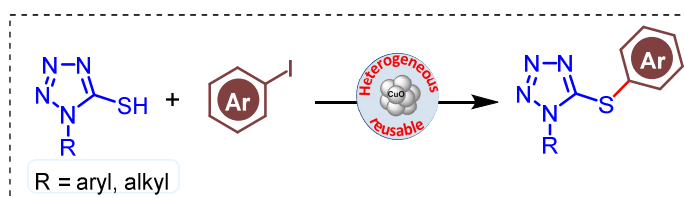
This thesis mainly focuses on the functionalization of Tetrazole and its derivatives using copper as catalyst source, followed by bio-based supported palladium nanoparticles as catalyst for C-C and C-O cross-coupling reactions. It comprises of five experimental works (chapters 2-5), chapter 5 contains two experimental works and six chapters in total. The schematic representation of the experimental works is shown in Figure 6.1.

**Chapter 2:** Direct C-N coupling of tetrazole and phenylboronic acid in presence of a 10 mol% copper complex catalyst system for the synthesis of regioselective 2,5-disubstituted tetrazoles.



**Chapter 3:** A protocol for the chemoselective formation of C-N bond using Cu(OTf)<sub>2</sub> as catalyst has been developed using heterocyclic thiones. The reaction occurs at the nitrogen centre over the sulphur leading to C-N bond formation

**Chapter 4:** S-arylation of tetrazole-5-thiones with arylhalides using copper oxide nanoparticles (CuO NPs) has been reported.



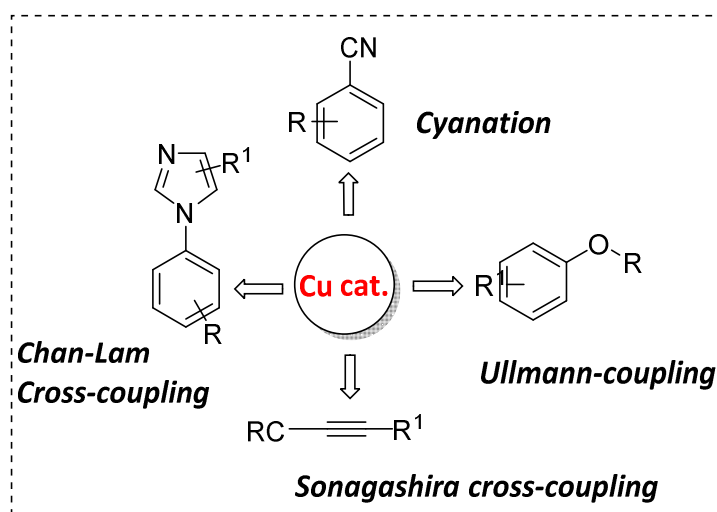
**Chapter 5:** This work reports a practical approach for C-O and C-C bond formation reactions catalysed by Palladium NPs supported on Luffa sponge (PdNPs@LS)

Figure 6.1 Table of contents of experimental works

## 6.2. Future Scopes

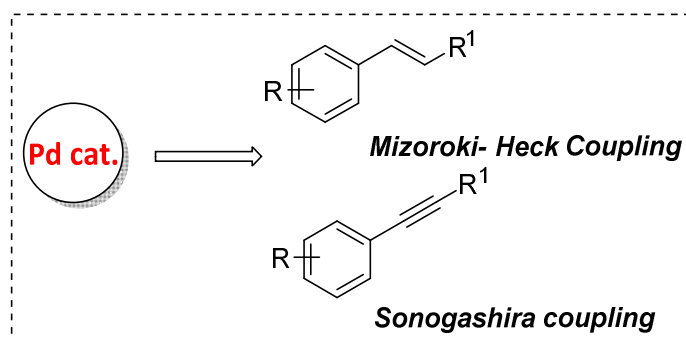
The current works described in this thesis have the potential to be extended to other useful transformations. Accordingly, the possible future scope of the work is described below:

Cu-complex can be further explored to other copper mediated organic transformations such as Cyanation reaction, Ullmann Coupling, Sonagashira cross-coupling and other Chan-Lam cross-coupling reactions as depicted in Scheme 6.1.



Scheme 6.1 Copper catalysed organic transformations

Similarly, already prepared bio-based derived Palladium catalyst can further be used for other cross-coupling reactions as well such as Mizoroki-Heck and Sonagashira cross-coupling reactions as depicted in Scheme 6.2.



Scheme 6.2 Palladium catalysed cross-coupling reactions